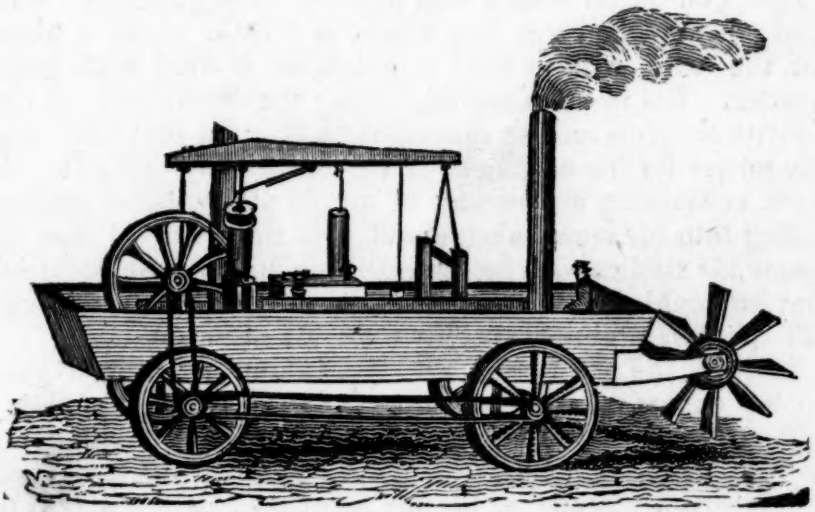
The Mechanic.

JULY, 1834.

[For the Mechanic.]

STEAM-CARRIAGES.



[Evans' Steam-Engines. See page 196.]

HAVING traced the steam-engine from its first invention to the successful application of its power for the purpose of navigation, by Fulton, it now remains for us to continue the subject, by a brief history of its application to land-carriages on common roads, and its superior advantages on railways. Two individuals, in particular, are claimants for the honor of this invention, both of whom also claim the invention of steam-boats; but as all claims to the invention

of the steam-boat have been considered in the preceding article on Fulton, we shall confine ourselves to the merits of their claims to the steam-carriage. As one is an American, if we were to confine ourselves to his account, we might be accused of undue prejudice in favor of our countryman, and therefore we intend to submit a condensed account of each, that our readers may judge which should wear the laurel. As the claim of Oliver Evans bears date a few years earlier than that of William Symington, we shall commence with his account.

In the year 1772, Evans, being an apprentice to a wagon-maker in Pennsylvania, endeavored to discover some means of propelling land-carriages without the use of animals; but after considerable study, he abandoned his attempt for the want of a suitable original power. A short time after this attempt, one of his brothers gave him an account of the effect of steam, which he had seen performed by a blacksmith's boy, by putting a little water into a tight gun-barrel with a wad over it. The gun-barrel was then put into the forge fire, when, in a little while, it blew out the wad, with as loud a crack as if fired with gunpowder. His mind recurred, during the description, to his favorite subject, and he immediately thought that here was the power for his carriages, if he could only apply it. A work containing an account of an old atmospheric engine falling into his hands also, about this time, caused him to renew his studies with increased ardor, and he soon declared that he could make steam-wagons, and had satisfied himself of their practicability by experiment.

In 1786, he petitioned the legislature of Pennsylvania for an exclusive right to use his improvements in flour-mills and steam-wagons in that state. They granted his petition as far as it related to flour-mills, but took no notice of his steam-wagons, as on this point they believed him to be insane. The act is dated March, 1787.

His next application was to the legislature of Maryland, to whom he explained his ideas in regard to steam-wagons, and by describing the great elastic power of steam, endeavored to show them the ease of reducing his principles to practice. The committee to whom it was referred, would probably have refused his petition as visionary, if Mr. Jesse Hollingsworth, of Baltimore, had not prudently observed, that as the grant could injure no one, he hoped the encouragement would be afforded, and there was a

possibility of producing something useful. A favorable report was accordingly made, May 21, 1787, granting to him, his heirs, or assigns, for fourteen years, the exclusive right to use his improvements in flour-mills and steam-wagons, in that state.

Being now secured in his right, in 1789, he endeavored to induce Benjamin Chandlee and sons, clock-makers, men celebrated for their ingenuity, to join in the expenses and profits of the project; but fearful of the difficulties attending it, they declined the concern. They however, certified that he had shown his drawings and explained his ideas to them. In the same year he went to Ellicott's Mills, near Baltimore, for the purpose of persuading Messrs. Jonathan Ellicott and brothers, to join him in the introduction of steam-wagons. They readily comprehended his ideas and drawings, having tried some experiments themselves on the power of steam, but fearing the difficulty of the execution, they also declined the proposition. He also communicated his project to Mr. Levi Hollingsworth, merchant, of Baltimore,* but he declined a partnership for the same reasons as the former. He afterwards endeavored to interest others in the merits and practicability of his schemes, but could find no one willing to risk the expense of the experiment.

About the year 1800, not having found any one willing to contribute to the expense, or even to encourage him to risk it himself, it occurring to him also that he had not yet discharged his debt of honor to the state of Maryland by producing a steam-wagon, he determined to construct one immediately. He first waited upon Robert Patterson, Esq., Prof. of Mathematics in the University of Pennsylvania, and explained to him his views, as he also did to Mr. Charles Taylor, steam-engineer from England; they both declared the principle new to them, and highly worthy of a fair experiment, and advised him earnestly to prove them.

* I certify that Oliver Evans did, about the year 1789, communicate a project to me, of propelling land carriages by power of steam, and did solicit me to join him in the costs and profits of the same.

Baltimore, November 16, 1812. LEVI HOLLINGSWORTH.

I do certify, that some time about the year 1781, thirty-one years ago, Oliver Evans, in conversation with me, declared that by the power of steam he could drive anything—wagons, mills, or vessels, forward by the same power, &c.

November 15, 1812. ENOCH ANDERSON.

These were the only persons to whom he applied, who had any confidence in his undertaking. In consequence of the above determination, he commenced building his steam-wagon, and had made considerable progress, when the idea occurred to him, that as his steam-engine was entirely different in form, as well as in principle, from those in common use, he could procure a patent for it, and apply it to mills more profitably than to wagons. He accordingly discharged his workmen, tried experiments, and procured a patent; he then applied his engine to flour-mills, grinding plaster of Paris, sawing marble, and other purposes where such a power was required.

In 1804, he constructed at his works, situated a mile and a half from the water, by order of the Board of Health of the city of Philadelphia, a machine for cleansing docks. He thus describes the experiment, 'It consisted of a large flatt, or scow, with a steam-engine of the power of five horses on board, to work machinery to raise the mud into flats. This was a fine opportunity to show the public that my engine could propel both land and water carriages, and I resolved to do it. When the work was finished, I put wheels under it, and though it was equal to the weight of two hundred barrels of flour, and the wheels fixed to wooden axletrees, for this temporary purpose, in a very rough manner, and with great friction of course, yet with this small engine I transported my great burthen to the Schuylkill with ease; and when it was launched in the water, I fixed a paddle-wheel in the stern, and drove it down the Schuylkill to the Delaware, and up the Delaware to the city, leaving all the vessels going up, behind me, at least half way, the wind being ahead. Some wise men undertook to ridicule my experiment of propelling this great weight on land, because the motion was too slow to be useful. I silenced them by observing, that I would make a carriage to be propelled by steam, for a bet of $3000, to run upon a level road against the swiftest horse they could produce, I was so confident that such velocity could be given to carriages.'

He labored to induce the proprietors of several of the turnpikes to introduce steam-carriages upon their roads, but did not succeed. In 1805, he published a work describing the principles of his steam-engine, with directions for working it in boats against currents, and carriages on common roads, and states his willingness to make a

carriage to run upon a railway, or level road, 15 miles in an hour, on condition that he should have double price if it should come up to that velocity, and nothing if it should fall short, and concludes by asking what more a man can do to test his invention than to ensure its performance?

This was his last attempt to call the attention of the public to his steam-carriages, yet, notwithstanding his experiments, and his promises, the call was neglected, and unable to incur the expense himself, the acts securing to him the right to use them, were rendered of no avail. The project was accordingly abandoned, and his talents were afterwards employed in the improvement of machinery for flour-mills, and introducing his steam-engine to different purposes in the arts.

WATER WORKS.

Under this head, at page 68, we made a few remarks on the subject of supplying water for various purposes; and stated our intention of pursuing it in our future numbers. We are happy in being able to state that our city government has appropriated $2000, for the purpose of making the necessary surveys, in order to ascertain the most eligible mode of supplying the inhabitants with pure water, and hope as soon as they are sure of being right, that they will 'go ahead.'

BORING FOR WATER.

A method of procuring water by boring the earth and sinking iron pipes, instead of digging wells, has been practised for a few years in this country, with considerable success, and supplies have been obtained in this way, in places where it was quite impossible to obtain good water by the old method.

Various tools have been contrived for boring and removing the different kinds of soil, and for perforating even the solid rock; and these operations have been carried on, in some cases, for several years, and to a depth of several hundred feet, before a supply of water of the right kind could be obtained; while in other cases, a few days labor, and a few feet of pipe, have been amply sufficient.

The machinery used for boring is very simple. A frame of wood, (which is boarded over to protect the workmen in bad weather,) supports one or more axles with wheels and cranks, which are used for raising the tools, and for operating with the boring and drilling apparatus.

The length of the pipes is about six feet, and they are put down as the work proceeds, the joinings of course being made water tight.

Some idea of the nature of the tools may be obtained from the following cuts and descriptions.

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7.

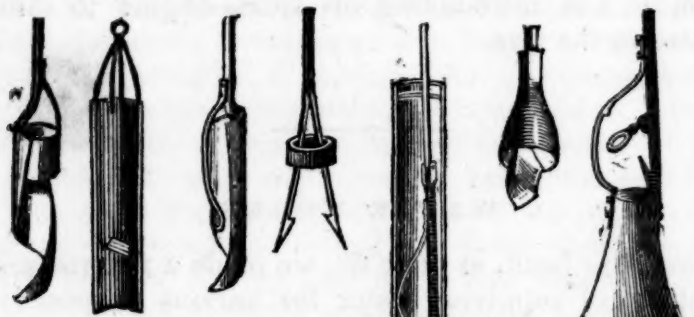


Fig. 8.

DESCRIPTIONS.

Fig. 1 represents the auger used for boring through the strata of common earth, or clay. This tool is not suitable for sand, or very coarse soil, as it is necessary there should be some adhesion, or it would not bring up the portion of substance it had passed through.

Fig. 2 is the tool used in sand, or very light gravelly soil, and is provided with a valve which, closing, brings up all that has passed through it.

Fig. 3 is used for hard clay, or clay and gravel mixed.

It is perhaps, proper here to observe, that these tools are all of the same diameter with the inner diameter of the iron tube.

Fig. 4 is a pair of nippers, or tongs, for bringing up loose stones, or other detached substances. In using them, the

ring is shoved up, and the arms expanded the full size of the bore, and when they have seized upon the object to be removed, and the shaft drawn upward, the ring slips down, and thus secures whatever is within them.

Fig. 5 gives a view of the iron tube as obstructed in its descent by a projecting ledge of rock, and, to remove which, a drill, (having a bow spring attached, for the purpose of giving it an effectual direction,) is made secure to the end of the shaft, and the operation of cutting away the rock commences by means of a cam-wheel; after which the tube is again forced forward.

Fig. 6 is a drill for boring through rocks; this must be made with great care in all its parts, for should it break in the hole, it would, in all probability, suspend the whole operation.

Fig. 7; this tool is called the bell; it is used to bring up a broken shaft. The wide part fits accurately to the tube, and, in descending, inducts the broken end of the shaft into an aperture fitted to receive it, above which a clevis is placed, and as the bell is drawn upward, the clevis presses the shaft against a steel barb, which is between the clevis and the top of the bell, by which means the shaft is secured, and the whole drawn up together.

Fig. 8 is a wrench, which is secured to the shaft by means of a screw, and serves as a handle to turn the shaft.

Mr. Levi Disbrow is generally understood to be the inventor of this method. We cannot say exactly what degree of merit this gentleman is entitled too; but it is certain, that boring the earth, and inserting pipes for the purpose of procuring water, was practised to some extent, in Europe, many years ago.

SUPPLY OF WATER TO THE CAPITAL OF CORFU.

The island of Corfu, the capital of which bears the same name, is situated at the mouth of the Adriatic. It is about 45 miles long, and 24 broad, and contains a population of about 50,000 souls. It was anciently known under the names *Scheria*, *Phæacia*, *Corcyra*, and *Deprano*. In the best days of Greece, the Corcyrians formed a powerful republic. In succeeding times this island belonged to the King of Naples; it was afterwards sold to the Venetians for 30,000 ducats. These maintained a fleet of galleys in the port, and a strong garrison to defend this and the neigh-

boring islands. In 1797, it was ceded to the French republic, by the treaty of Campo Formio; but, in 1799, it was surrendered in capitulation, to the united forces of the Turks and Russians. At the treaty of Tilsit, in 1807, it was again ceded to France; but, by the treaty of Vienna, it was placed under the protection of Great Britain, and it now forms part of the republic of the Seven Islands. The air is salubrious; the land is generally fertile, though some mountainous parts are barren; and the fruit is excellent. Citrons, oranges, and grapes of a most delicious flavor, honey, wax, and oil, are abundant. Salt, however, forms a great source of its wealth, and of the employment of the people.

Yet, with all these revolutions, this change of masters, and these natural advantages, the city had no water besides what was collected in tanks, or brought on the backs of asses, and, as a natural consequence, the supply was both scanty and bad. Not one of its mighty conquerors or negotiators attempted to avail himself of its natural and inviting facilities, for introducing a stream of this salubrious fluid, until it fell into the hands of the British. These, however, with true characteristic ingenuity, industry, and genuine patriotism, have lately surmounted every obstacle, and nobly supplied the deficiency.

On the 7th of August, 1831, the city of Corfu was one scene of rejoicing, on account of its being the first day that the water was introduced, in iron pipes, from a distance of about six miles. In a square, a temple was erected, from the centre of which, to the astonishment of the inhabitants, a large column of pure water, fifteen feet high, suddenly issued forth. The burst of joy, which the appearance of the stream excited, cannot easily be described. The bishop, at the head of his clergy, solemnly blessed it. These were accompanied in the procession, by the senate, the lord high commissioner, the military, and the principal inhabitants. In the evening, the city, esplanade, &c., were splendidly illuminated; while from the windows were hung the 'gilded tapestries,' which rendered the whole spectacle exceedingly magnificent.

To persons who have always been favored with an abundance of pure water, this may appear an ostentatious parade; but the vast population of a city, whose ancestors, for all past generations, had been compelled to purchase a supply that was both scanty and bad, well knew how to

estimate the value of this important acquisition. We have more reason to be amazed, that while the mighty troublers of the earth were alert to drench conquest with blood, no efforts should be made to introduce this necessary article; and, to the honor of England, from which the iron pipes were sent, it will be recorded in the archives of the island, that water was first brought to the city of Corfu by the English, through the application of their superior skill in the mechanic arts.

[From the Journal of the Franklin Institute.]

MACHINES FOR PARTING COMBS.

[From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.]

Materials for combs are—1, boxwood,—2, ivory—3, horn—and 4, tortoiseshell.

These being cut into pieces of the proper size, and the general form of the comb having been given to them by common tools, such as rasps, scrapers, &c. the next, and most important part of the process, is cutting the teeth.

This was formerly done, in all cases, by means of a double saw, consisting of two parallel blades, one of them being deeper than the other, so that when the deepest blade has cut to the whole depth of a tooth, the other shall have cut only to the depth of half a tooth. In using it, the deep blade makes the first cut at a little distance from the outside of the material, so that by the first action of the saw the outer side of one tooth and half the inner side of the same tooth are cut. The saw is then advanced one tooth, so that the deep saw rests in the cut made by the shallow saw, while this latter is ready to form half the outside cut of the second tooth. Thus the saw is advanced a tooth at a time, the intervals between the teeth are rendered equal, and half the cut for the deep saw being already made, the tool is prevented from swerving, or cutting teeth of unequal thickness.

Soon after the invention of the circular saw, it was applied to comb-cutting, by fixing on one axis two circular saws, one of greater diameter than the other, and regulating the distance between them according to the fineness of the

teeth to be cut. Both the straight and circular double saws are now in use, the former being still applied to cutting combs out of all the four above-mentioned materials, the latter being used chiefly for combs of box and of ivory.

Boxwood and ivory, if subjected to the perpendicular action of a cutter would break and splinter; but horn and tortoise shell, being of a laminated texture, and capable of being rendered soft and flexible by heat, will yield in this state to the action of a sharp vertical cutter without splintering.

About twenty years ago, the principal house in London at that time for the sale of combs, had received from abroad some patterns of ornaments like the spikes and balls of coronets, to be attached to the tortoise shell combs.

They gave the order to execute these to an ingenious artist of the name of Ricketts, who contrived a punch, by the successive pressure of which on a thin piece of warm tortoise shell, he cut out the pattern, piece by piece. On disengaging the pattern from the other part, he observed to himself, 'here are two combs cut out of the material for only one.'

Improving on this hint, he soon contrived a machine in which a single cutter descended vertically, being put in motion by a treadle and wheel: the bed on which the tortoise shell was fastened was notched at the side, and these notches fitted into, and corresponded with, those of a rack placed parallel with it. After every cut the bed was moved forward by hand the distance of a single notch, and thus an equal interval between all the cuts was secured. But the form of the tooth of a comb being that of a very long triangle, it was necessary that, as the bed was shifted forward, notch by notch, there should also be an alternative motion given to the bed: this likewise was given by hand; and thus the first rude machine for parting combs, that is, for cutting one set of teeth out of the intervals of another set, was completed.

When the knowledge of this machine began to spread abroad, various contrivances were invented to advance the bed, and give the necessary alternate change in direction, by machinery. In some cases, this alternation was given to the bed, in some to the cutter itself.

Previous to this time, however, it had occurred to the original inventor, Mr. Rickets, that the machinery necessary to produce this alternation of direction might be dis-

pensed with by making the cutter double, that is, composed of two blades set obliquely, so as nearly to touch at one end, and at the other to be as far apart as the width of a tooth, at the same time the blades made a return at their ends to liberate the extremities of the teeth.

It is evident that, while the cut is making, the material must be stationary, and that in the interval between the rise and descent of the cutter, the bed must have advanced the breadth of a tooth. This was effected in Mr. Ricketts' double cutter machines by working the cutter alone by a treadle, and advancing the bed by a screw, to the end of which a winch was fastened, so that one complete, or one half turn, gave the necessary advance, a pause being made after each turn or half turn, to bring the bed to a stop while the cutter was in action.

Mr. Roger's machine obtains this end without the use of a treadle, by means of a single winch. The axis to which the winch is fixed gives motion to the cutter by means of a crank, and on the axis is a wheel having part of the cogs removed; this wheel takes into a common cog wheel on the axis of a screw, by the turning of which the bed with the work on it is moved forwards. Hence it is evident, that while the machinery for raising and lowering the cutter is in constant action as long as the winch is turned, the screw, which gives motion to the bed, is still, and out of action, during that part of the revolution of the winch in which the cogs of the two wheels are not bearing on each other. By enlarging the space from which the cogs of the second wheel are cut away, the interval between one tooth and another is diminished; so that any given distance of teeth may be obtained by putting on to the axis of the screw, a wheel with the proper number of cogs.

The machines for parting combs, in all their modifications, have this advantage, of cutting two sets of teeth out of the same quantity of material, as with the common saw, is sufficient only for one set.

But every scale of tortoise shell is wedge-shaped at the margin, and therefore it is only to the thick pieces, cut out of the middle part of the scale, that this new invention can readily apply, for the wedge-shaped margin is not thick enough for the back of a comb. But, on the whole, the advantage as regards tortoise shell is very great, for the prime cost of rough shell of fine quality is four guineas per pound—a price greater than that of silver.

In many cases, however, the thin edges of a piece of tortoise shell may be strengthened by soldering it to a thicker or larger piece for a back. This is done by heating the shell and pressing it at the same time; but much care is required lest the shell be overheated, in which case the lamellar texture is destroyed, and the substance becomes as brittle as glass. In Germany and in France many combs are made, the ornamental part of which is stamped by strong pressure in hot steel dies, and two or more pieces of tortoise shell are united in the same manner; but the color of shell so treated is injured, besides being rendered very brittle.

The best English makers, after smoothing and rasping the two surfaces that are intended to be united, place them between two thin boards, and insert the whole in the chops of a screw-press. The press is put for some hours into boiling water, and is tightened from time to time; and thus, by allowing a sufficient time, a perfect junction is obtained at a heat so low as not to injure either the color or texture.

EXTRACTION OF FOREIGN SUBSTANCES FROM THE EAR.

We extract the following, from the 'Boston Medical and Surgical Journal,' not only on account of its usefulness, but as a proof of the benefit arising from a study into the principles of science. It is this useful discipline of the mind, and this only, that can, and will raise the Mechanic to that estimable point to which he should aspire.—Eds. Mec.

Sir,—The notices of 'Intra-Auricular Lithotrity,' and other methods of extracting foreign substances from the external meatus of the ear, recently published in your Journal, remind me of an ingenious method employed some time since, in a case of this kind, by Mr. Eli Whitney Blake, a scientific mechanic of this town.

In 1829, a child about three years old, living in Whitneyville, in the neighborhood of the extensive gun-manufactory superintended by the Messrs. Blakes, crowded into the ear a small stone, which, in the course of six or eight days, produced severe irritation and inflammation. The extreme soreness of the ear, and the violent resistance made by the child, appeared to forbid the ordinary methods of operating.

It occured to Mr. Blake that something might be fastened to the stone by means of glue or some other adhesive substance, by which the stone might be extracted. Several different preparations were tried without success—owing to the difficulty of drying these preparations in the humid cavity of the ear, sufficiently to afford a proper degree of tenacity. He then selected a strong solution of Gum Shellac in Alcohol—considering that the volatility of alcohol rendered it preferable to water, as a solvent for this purpose. A small portion of cotton was tied into a knot, with a strong thread, and fastened to a piece of quill, a little more than an inch long, by passing the ends of the thread through the hollow of the quill. The cotton was then charged with the shellac solution, and introduced against the stone, where it was allowed to remain more than twenty-four hours; and, in order to hasten the evaporation of the alcohol, hot air was occasionally blown into the ear with a bellows—a dish of burning coals being held under the valve of the bellows. The plan was successful, and occasioned scarcely any pain. From the swelling of the parts, the stone had become very firmly impacted within the ear, and considerable force was required to extract it. The tenacity of the substance employed was, however, abundantly sufficient, as the stone, after extraction, was found adhering to the instrument with a force sufficient to raise twenty or thirty ounces.

Yours, &c.

New Haven, June 14th, 1834. CHARLES HOOKER, M. D.

[For the Mechanic.]

FIRE KINGS.

THE wonderful feats of M. Chabert and others, of withstanding heat of high temperatures, would naturally excite considerable curiosity to discover the methods which they pursued to prevent its effects. To those fond of investigating these marvellous and imposing feats, our information may be interesting. It is true that no confession of theirs will permit us to say that their antidote against the effects of red hot iron, boiling oil, or burning coals, is discovered; yet we believe it to be the same that Professor

Sementeni has published, and of which we shall speak hereafter.

By the instances which we shall introduce, it will be readily discovered, that the Salamander power which they possess, to enable them to enter a heated oven with impunity, is, merely to clothe themselves in thick woollen garments, by which the perspiration arising from the body may be retarded in its evaporation. It is a profuse perspiration, that enables sugar-bakers and others exposed by their business, to undergo a heat far greater than that of the most burning climate on the globe. That there was nothing very peculiar in the constitution of M. Chabert, or the Spaniard, Martinez, by which they could broil a beefsteak in the same place with themselves, we believe we shall be able to substantiate.

The first account we have of an attempt of this kind, is given by Messrs. Tillet and Duhamel, French philosophers, who being at La Rochefoucault, in 1763, the daughter of a baker went in their presence into an oven, the temperature of which they estimated at upwards of 260° Fah. or far beyond the boiling point of water. She remained in this extreme heat about twelve minutes, without suffering any inconvenience from it. This experiment was afterwards repeated by another girl with the same result.* At a later period, Dr. Fordyce, the celebrated English physician, remained for a considerable time in a room, heated by stoves to the temperature of 260° Fah. The lock of the door, his watch and keys lying on the table burned his hand, an egg became hard, and although his pulse beat 139 in a minute, a thermometer held in his mouth was only two or three degrees higher than ordinary. He perspired profusely, and the experiment proved to him, that evaporation from the surface of his body, was sufficient in the midst of this great heat, to keep his temperature on a level with that of the human body on ordinary occasions.

A similar experiment to ascertain the degree of heat it is possible for a man to bear, was made in July, 1828, at the New Tivoli, at Paris, in the presence of about 200 persons, among whom were many professors and physiologists, who had been especially invited to attend, by the physician Robertson, director of that establishment. The man upon whom the experiment was to be tried was a

* Mem. de l'Acad. Sciences, 1764, p. 185.

Spaniard of Andalusia, named Martinez, aged forty-three. A cylindrical oven constructed in the shape of a dome, had been heated for four hours with a very powerful fire. At ten minutes past eight, the Spaniard, having on large pantaloons of red flannel, a thick cloak also of flannel, and a large felt after the fashion of a straw hat, went into the oven, where he remained seated on a footstool for the space of fourteen minutes, exposed to a heat of from 45° to 50° of a metallic thermometer, the gradation of which did not go higher than 50°. He sang a Spanish song while a fowl was roasted by his side. At his coming out of the oven, the physicians found that his pulse beat 134 in a minute, though it was but 72 on his going in. The oven being heated anew for a second experiment, the Spaniard re-entered, and seated himself in the same attitude at three quarters past eight, ate the fowl, and drank a bottle of wine, to the health of the spectators. At coming out, his pulse was 176, and indicated a heat of 110° Reaumur. Finally, for the third and last experiment, which almost immediately followed the second, he was stretched upon a plank, surrounded with lighted candles, and thus put into the oven, the door of which, was this time closed: he was there nearly five minutes, when all the spectators cried out, 'Enough, enough,' and anxiously hastened to take him out. A noxious, and suffocating vapor of tallow filled the inside of the oven, and all the candles were extinguished, and melted. The Spaniard, whose pulse was two hundred on coming out of this gulf of heat, immediately threw himself into a cold bath, and in two or three minutes after, was on his feet, safe and sound.

About the year 1809, one Lionetto, also a Spaniard, astonished not only the ignorant, but chemists, and other men of science, in France, Germany, Italy and England, by his insensibility to the power of fire. He handled with impunity red hot iron and molten lead, drank boiling oil, and performed other feats equally miraculous. While he was at Naples, he attracted the notice of Professor Sementeni, who narrowly watched all his operations, and endeavored to discover his secret. He observed in the first place, that when Lionetto applied a piece of red hot iron to his hair, dense fumes immediately rose from it; that when he touched his foot to the iron, similar vapors ascended, which affected both the organs of sight, and smell. He also saw him place a rod of iron nearly red hot, between his teeth,

without burning himself; drink the third of a table-spoonful of boiling oil; and taking up melted lead with his fingers, place it on his tongue without apparent inconvenience.

Anxious to discover the means used by Lionetto to render himself capable of thus enduring the application of heat, Sementeni performed several experiments upon himself, and made many important discoveries. He found that by friction with sulphuric acid diluted with water, the skin might be made insensible to the action of the heat of red hot iron; a solution of alum, evaporated until it became spongy, appeared to be more effectual in these frictions. After having rubbed the parts, which were thus rendered in some degree incombustible, with hard soap, he discovered on the application of hot iron, that their insensibility was increased. He then determined on again rubbing the parts with soap, and after this found that the hot iron not only produced no pain, but that it actually did not even burn the hair. Being thus far satisfied, the Professor applied hard soap to his tongue, until it became insensible to the heat of the iron, and after having placed an ointment, composed of soap mixed with a solution of alum upon it, boiling oil did not burn it; while the oil remained upon the tongue, a slight hissing was heard like hot iron thrust into water; the oil soon cooled, and could then be swallowed without danger.

These are the results of the experiments, performed by Professor Sementeni, and certainly tend to explain the astonishing performance of Lionetto, and other fire-eaters. It is evident that they prepare their skin and tongue, in a similar manner, previous to their exhibitions. With regard to passing a hot plate of iron over the hair, it seems evident, that the latter was first saturated with a solution of alum, or sulphuric acid. His swallowing the boiling oil ceases to be a phenomenon, when it is observed in order to show its high temperature, he threw pieces of lead into it, which in the process of melting, absorbed part of the heat of the oil; and the small quantity poured upon his tongue, already prepared to receive it, cooled before he swallowed it. It is also clear, that he might put the molten lead upon his tongue with impunity, and suffer less inconvenience, if possible, than from the oils, by the greater heat of which, it had been melted. He might however, have used a mixture of lead, tin, and bismuth, which will melt in boiling water.

From these considerations, and the researches of scientific men, who have successfully repeated the experiments, the apparently miraculous feats of M. Chabert, Dr. Divine, and other fire kings, should no longer be considered as unaccountable, or their power of withstanding heat, peculiar to themselves. JUNIUS.

Boston, July 4th, 1834.

[For the Mechanic.]

PORTABLE TRIGONOMETRY.

This science, though but an application of Geometry, is of more practical use than any one other branch of mathematics. Having seen some articles with the above title in the London Mechanics' Magazine, I was induced to send you a few remarks upon the plan there proposed, which, I thought, might serve to elucidate, in some degree, this branch of knowledge.

Simple as the plan proposed is, it is not complete. Logarithms, as being not essential to trigonometrical operations, but merely an aid for readier calculations, are done away with, and the table of triangular parts, or sines, tangents, &c. much abridged. But in simplifying so far as this, these tables, with the idea of having only what was absolutely necessary, much more might have been done. The table, occupying one page, as it does there, might, with equal usefulness be made to cover only *one third* of a page, by omitting the tangents and secants. Every case of plane trigonometry is soluble by means of sines alone. To render this clear, I will give formulas for each several case, founded on the use of sines only.

First of right angled triangles. One angle here is always known.

Case 1.—Angles and one leg given. The sine of one angle is to the sine of the other as the known side to the unknown.

Case 2.—Hypothenuse and angles given. Radius is to hypothenuse as sine of one angle to its opposite leg.

In the cases where more than one side is given, the angles are found by making the sides proportional to the sines of the opposite angles.

The following formulas will answer for all oblique angled triangles.

Cases 1 and 2.—Angles and one side given, or two sides, with an angle opposite one of them.

Sines of angles proportional to the opposite sides, and vice versa.

Case 3.—Two sides with the included angle given.

This case is the most difficult of all, yet it may be solved in the following manner.—Drawing a line from one of the angles not given, perpendicular to one of the other sides, we have one triangle in which one side, and two angles are known, one of which is a right angle, to be calculated by sines as above. The section of the base cut off, on the side of the perpendicular opposite the known acute angle, and the perpendicular also being found, we can then calculate the right angled triangle on the other side.

There is no difficulty, as there might seem to be, in the case where the given angle is obtuse, and the perpendicular falls without the triangle. The base must be produced likewise to meet it, and the two triangles will both be one side of the perpendicular, but the calculation will, nevertheless, be similar.

Case 4.—The three sides given. The triangle being divided into two right angled triangles, they may be calculated in the usual way.

EUCLID MINOR.

[For the Mechanic.]

ESSAY ON MATHEMATICAL QUANTITIES.

THE following article contains the substance of a lecture by David Gould, Esq., before a class of the Mechanics' Lyceum, of this city, at the commencement of a course of lessons in geometry, attended during the past winter.

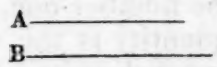
PREVIOUS to entering on the study of that important branch of mathematics to which the members of this class propose to give some attention, it is presumed they will consider it not inappropriate to listen to a few observations on the nature of mathematical quantities in general.

Everything which is susceptible of a change in quantity, by addition or subtraction, which may be exactly measured or estimated, may be made the subject of mathematical

investigation. Of this nature, are numbers, lines, superficies, solids, weight, velocity, time, &c.

It will be obvious from this partial examination, that mathematical quantities consist of several different kinds. Quantities which differ from each other only in magnitude, or in the arbitrary relations which they may sustain, are of the same kind. Any two or more *numbers*, whatever may be their magnitude or relation, are always of the same kind. The same observation applies to any number of *lines*. But between numbers and lines there is a difference, besides those of magnitude and relation, and they are of different kinds.

Any two quantities of the same kind may be compared with each other in respect to magnitude, and from every such comparison there will result the relation either of equality or difference. But between quantities of different kinds no such comparison can be made.



If the lines A and B be compared, it will appear that B is the longer of the two, but it cannot be said to be a quantity greater or less than, or equal to the number *five*, or any other number. It will be equally impossible to institute a comparison between the line A or B and a superficies. A line may be extended from the earth to the most distant star in the visible firmament, and beyond that to the most distant point in space which imagination can conceive; yet it will not be equal to the smallest superficies which can be made an object of thought. Nor can it be said to be either greater or less. It is equally impossible to institute a comparison between a line and a solid, or between a superficies and a solid.

In algebra, quantities are sometimes distinguished as positive or negative. The difference between them is a difference in their relation to other quantities, and not a difference in kind. The supposition sometimes admitted, and oftener implied on the manner of treating them, that there is a difference in their nature, is erroneous.

Mathematical quantities can be increased by the addition, and diminished by the subtraction of such quantities only as are of the same kind with those which are first considered. Thus if a number be increased by addition, the increment must be a number, and not a line, a weight, or a

measure of capacity. If a line be diminished, the decrement must be a line and not a number, a superficies or a solid.

Any quantity whose magnitude is invariable may be made a standard of measure for all other quantities of the same kind. Thus a line of a given length, called an inch, may be the standard by which all other lines may be measured or estimated. A square inch of superficies may also be considered the standard of measure for all surfaces, and a cubic inch, for all solids. But it would be absurd to undertake to compare these different standards with each other. The attempt to do so would only produce confusion.

The following are a few of the various kinds of mathematical quantities.

Number. This arises from a comparison of several objects, resembling each other in one or more particulars, with a single object, or another group. Its standard of measure is a unit, or the number one, and there can be no other. This kind of quantity is the subject of arithmetic.

Lines, *Superficies*, and *Solids*, and their respective possible standards of measure, have already been mentioned. It is only necessary to observe that convenience sometimes requires greater standards of measure, specifically of the same kind as those alluded to.

Angles. Of these there are two kinds, namely, those formed on a plane, by lines meeting each other, and those formed by three or more superficies meeting in a point. Of the first kind a right angle, formed by one line falling upon another so that the adjacent angles shall be equal, may be considered the standard. The standard for the other kind of angles may be the angle formed by the meeting of three right-angled plane superficies. No relation of equality or difference can exist between these two kinds of angles, or between either of them and any other kind of quantity. The five last mentioned kinds of quantity, namely, *lines*, *superficies*, *solids* and the two kinds of angles, are the subjects of *geometry*.

Gravity. Of this there are two kinds, gravity of mass, and gravity of species, unlike each other, and differing in their nature from all other quantities. The standard of the gravity of mass, is the weight of some given quantity of matter. Gravity of species is that which results from comparing quantities of matter equal in bulk, but of different kinds, with each other in respect to gravity. Of this kind

of quantity the specific gravity of water is generally considered the standard.

Time. Our notion of this kind of quantity is derived from observation of the succession of different actions or operations in nature. It is measured indirectly by comparing the spaces passed over in succession by bodies supposed to have a uniform motion.

Velocity. The idea of this kind of quantity is obtained by comparing the motion of bodies passing over a greater or less space in a given time. It is generally designated by mentioning the space passed over and the time in which it is passed over.

Temperature. This is the power of communicating heat possessed by different bodies, or by the same body in different states. It is measured indirectly, by observing the effects produced on an instrument called a thermometer.

It is obvious, that some of the quantities enumerated above, are of such a nature, that given quantities of the same kind cannot be applied to them conveniently for the purpose of direct measurement. Of this nature are angles, time, velocity, temperature, &c. In such cases the measurement is effected indirectly. Angles are measured by the instrumentality of circular arcs; portions of time by the hands of a clock, to which a uniform motion is given by machinery; and velocity by the spaces passed over by moving bodies in a given time. But in every case the standard of comparison by which a quantity is estimated to be greater or less, must be a quantity of the same kind with that which is measured. If a quantity increase till it becomes any number of times larger than at first, or if there be two quantities of the same kind of which one is any number of times larger than the other, the number which expresses the result of such comparison, is called the *ratio* of the quantities.

If two quantities of different kinds increase in such a manner that if one of them become any number of times greater than at first and the second likewise in the same time, or on the same conditions, becomes the same number of times greater than at first, the ratios of increase between the quantities are equal. If there be three quantities, viz. a line one inch in length, the number ten, and a weight of twenty pounds, let them be increased in equal ratio; then if the line be increased to ten inches, the number will become one hundred, and the weight two hundred pounds. We may express these relations by saying, as the line of

one inch is to the line of ten inches, so is ten to a hundred, or so is the weight of twenty pounds to the weight of two hundred pounds. Between quantities of different kinds, therefore, there may be equal ratios of increase, or the ratio between two quantities of the same kind may be the same as between two other quantities of a different kind. But since two quantities of different kinds cannot themselves be compared with each other in respect to magnitude, there can be no such thing as a ratio between them.

If any number of quantities of the same kind have any given relations among themselves, depending on magnitude alone, there may also be the same number of quantities of any other kind which shall have all and precisely the same relations among themselves; and for the purpose of investigating those relations, the latter may be considered the representatives of the former.

Thus all the relations depending on magnitude alone which can exist between two lines, of which one is one inch and the other ten inches in length, may be expressed by the numbers one and ten. The lines, however, may have relations depending on position, which cannot be expressed by these numbers alone.

There are three principal methods of representing mathematical quantities, viz., by numbers, by geometrical lines, and by letters or symbols having an arbitrary value. A given quantity, for many purposes, may be represented by the number *one*, twice that quantity by the number two, and three times the same quantity by the number three. The same quantities may also be represented by lines one, two and three inches in length, or by lines of any other length having these proportions among themselves. We may also designate the first quantity by the letter a, the second by $2a$, the third by $3a$.

Analogous to these three methods of representing all quantities, and depending on them, are the three kinds of mathematical investigation, viz., Arithmetic for numbers, Geometry for lines, and Algebra for arbitrary symbols.

Relations are expressed, and investigations made in each, in a manner peculiar to itself, but analogous in one, to that in the others, and there ought not to be the least appearance of discrepancy in the results.

If the expressions by the different methods of representation are not perfectly consistent with each other, the expression by one or other of the methods is either erroneous, or its reasoning is not understood.

[From the Railroad Journal.]

PROBABLE RESULTS OF RAILROADS.

SIR:—Has it never occurred to you that the capital vested in many railroads and canals is likely, if not exceedingly profitable at the commencement, to be eventually lost, from the roads and canals being superseded by others which may be made afterwards. The great and ultimate object of these improvements is to facilitate exchanges—to cheapen and expedite transportation to and from market—as, between the great coal region, or between the great agricultural west and the best market, whether Philadelphia, New York, or Boston. Now, if it be assumed that transportation by railroads, or by some better roads, steam being the impelling power, shall supersede, where practicable, *all other modes of locomotion*,—and I do not suspect myself of being alone in the opinion that there is no extravagance in such an assumption, particularly when we notice the progress of things in Europe—it is no more than reasonable to begin to contemplate, and try to foresee and act upon the natural and inevitable results which must follow, and to lay them before the public, that they may be fairly in view, and have proper consideration in the mind of every man, or company, when coming to a determination in regard to any proposed improvement, both as respects its location and the manner in which it shall be completed, or the amount of capital which may be safely invested in it.

The climate and productions of Europe and North America are so nearly alike, that as the state of science and the arts in these quarters of the world continues to come nearer to an equality, it is fair to conclude that the exchanges of merchandize will hardly keep pace with the increasing population of America. Still, as the condition of men is improving, and society and nations are becoming more intimate and friendly in their relations, and curious in their inquiries, we may suppose that travel for gratification will greatly increase between the two. This is proved by the number and constant increase of fine ships as packets; and it fairly indicates, in connection with the extent to which steam-boats are coming into use, and the long voyages which they occasionally make, that the time is not distant when the packet-ships will be propelled by steam.

No railroad can be laid across the Atlantic. It will be an object to have each of the two ports in Europe and America from whence most of these ships may be expected to depart for the other, situated conveniently as it respects the interior parts of the country, and as near together as may be. The wearisomeness of a long sea voyage will render these considerations indispensable, and may lead to some changes not now much thought of.

But to leave this part of the subject for a while, and dwell more particularly on our own United States.

To attain the greatest rapidity of motion will always be an object of controlling importance, and therefore level regions will be greatly desirable for the location of the principal thorough-fares. The intercourse and exchanges between the north and the south must increase vastly beyond all precedent, and probably beyond all present anticipation of the most enthusiastic; for as speed of transportation increases, and the cost is reduced, the productions of each of the various climates will be vastly more consumed in the other climates; and the assumption is, that transportation by land will gradually take the place of water navigation, first, for persons travelling, and then for merchandize, and particularly on account of its expedition, safety, and regularity. This consideration is made stronger, from the fact that much of the interior, and the finest portion of North America, and that which will soon be the most productive and most densely settled, and of course require the greatest exchanges of this character, is already as near by land to the most important productions of southern climates, as it is to our eastern commercial ports. It is not too early, then, to begin the inquiry, where shall be our principal and leading roads? for it is plain that they are not yet located, and that they cannot be determined on judiciously without the most grand and enlarged views, and the most extensive and accurate surveys.

Without attempting to speak of details, which can, of course, be only determined by such surveys, it is pertinent, and may be profitable to notice, that the formation of the country and the condition and wants of the citizens, present and future, clearly indicate that the road already commenced at Albany must be continued without any regard to navigable waters, on the best and most level ground westward, indefinitely; that another road from Norfolk, or perhaps from Boston, must proceed south-

wardly over the level region, near the coast all the way, to some harbor, where a town is yet to spring up, near the south cape of East Florida, from whence there will be a busy steam-boat intercourse with Havana; that a branch of this road will proceed, say from Savannah, to New Orleans, and thence into Texas, and onward—onward; that another principal road will be from this new city on the Cape of Florida, into the great valley of the Mississippi. This brings me back to the thoughts which put me upon this essay, the errors likely to be made in the location of railroads. I perceive some are designed to communicate only between one inland water navigation and another. These may prosper long enough to refund their cost; but the day is not distant when they will have comparatively little value.

Finally, as your journal is likely to be extensively preserved for future reading and reference, and as I am an old man, and shall hardly trouble you many times more, I ask of you the further favor to record a few prophecies.

First, fresh-water navigation, including that of the Mississippi and all its tributaries, will be discontinued, probably within twenty years.

Secondly, New Orleans, and all cities in unhealthy situations, will greatly decline, and new cities and towns spring up in more healthful and advantageous situations, and the queen of these, will be somewhere at a point not yet thought of in the great valley.

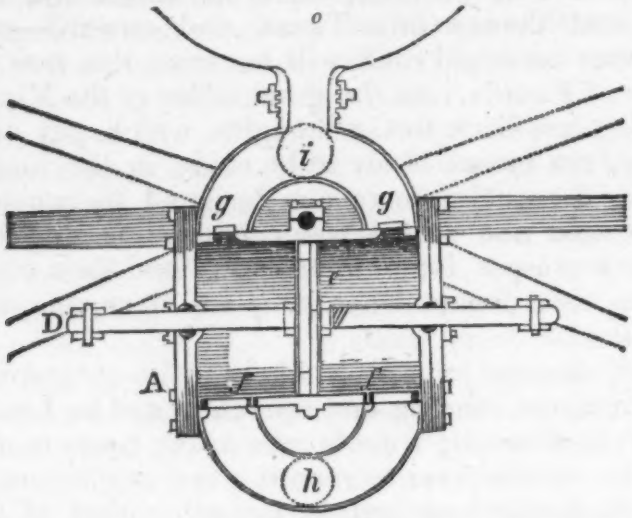
And thirdly, either Boston or Halifax is destined to take the sceptre from the highly favored city of the island.

And, to conclude, again I would most respectfully hint to the men of Boston (and for this I hope they will remember my children) two things—first, to spare no pains, nor grudge any capital, either in the location or construction of their westward and southward railroads; and secondly, to turn their attention to European steam-packets on a large scale. I beg pardon: Boston folks need no hint from me on their own affairs. C. O.

NEW FIRE-ENGINE.

BY MR. BADDELEY.

[Abridged from the London Mechanics' Magazine.]



Sir:—The accompanying drawing exhibits, in part, a fire-engine that I have contrived, on the principle of De la Hire's double acting pump, which I believe to be one of the most compact ever designed, of equal power. Fire-engines, with the pistons working *horizontally*, were in use at Nuremburg, in 1657; but of their internal construction, nothing further is at this time known. The nearest approach to the form of the engine I have adopted, will be found in Mr. Braithwaite's steam fire-engine; there is, however, a considerable difference between them, my engine possessing several novel peculiarities of arrangement, which will be understood by reference to the drawing. A, is the cylinder, with a flange at either end; D, is the piston rod, working through stuffing boxes in the end plates of the cylinder, and *e* is the piston. *ff* are the two entrance, and *gg* the exit valves. The suction pipe is screwed on at *h*, the delivery pipe at *i*. There are two sectors, one on each side, turning with the main axle, and worked by the levers. The sectors, by means of fiddle-chains, communicate motion to the frame, which is attached to, and works the piston-rod. The alternate up-and-down motion of the handles, causes the piston to traverse backward and forward in the cylinder; each alternate motion

discharging nearly the whole contents of the cylinder, which passes up through the valves *gg* out of the exit pipe. The air vessel *o* renders the stream perfectly uniform and regular. In the above sketch, the engine is represented with one of Barton's expanding metallic pistons. The valves are of copper, hinged to their places; and there is not a single particle of *leather* about the whole machine. An engine so constructed, therefore, might be laid aside and neglected for an indefinite period of time, without becoming in any way defective. A cupped leather piston may, however, be easily adopted, if preferred, and perhaps, for an engine in continual use, would be more advantageous, as the metallic piston would require more lubrication than could conveniently or effectively be afforded. Oil is introduced occasionally into the cylinder through an aperture at the top, otherwise closed with a small thumb-screw. Besides the firm and compact nature of this engine, it is lighter, and has fewer parts than any other engine of equal efficacy. The entering and exit waterways are made of rolled sheet copper, soldered up, thereby combining strength and lightness with a very free waterway. This latter circumstance is a point of much importance, but one that has not yet been sufficiently attended to in the construction of hydraulic engines. A part of the working mechanism of the engine only, is represented in the drawing, which may be mounted at the end of a cistern of the usual form and dimensions, in which it will occupy but a small portion of space. The diameter of the cylinder is seven inches, with a six inch stroke for the piston, and is placed crosswise in the cistern.

W. Baddeley.

[For the Mechanic.]

MY NOTE BOOK.—NO. V.

In the present paper, we propose to give a few practical recipes relating to masonry. Considerable complaint has been made, that in almost every other branch of the arts more information and useful recipes have been given than in those of masonry and carpentry. If there is any fault in this respect, it must partially rest upon those engaged in the business. If a superior method of making a brilliant

wash, a durable mortar, or a tight joint is discovered by one, it seems not so to be his aim to render it useful to his fellows, as to preserve it a *profound secret;* and if it cannot be rendered subservient to his own benefit, to prevent others from enjoying the fruits of his discovery.

This feeling, which is too universal among mechanics to apply merely to one class, causes them to lose sight of the principle, that by giving information to others, they are laid under a similar obligation to them. The reason why it appears to be a feeling more particularly among masons and carpenters is, that while almost every other of the arts can be elucidated and improved by professors and students of science, the processes connected with masonry and carpentry can, comparatively, be essentially improved by themselves alone. This renders evident the cause why more has not been said upon these subjects in magazines, and places in bold relief, the necessity of each communicating to others such information as may be useful to them, and will not materially injure themselves. If mechanics were to be governed by such motives, the effect would soon be apparent; the good feelings which a liberal spirit would engender, and the greater value of the processes thus given, from being the result of experience and practice, would produce changes both salutary in their business and pleasing in their intercourse with each other.

To Improve Mortar.—The addition of burnt bones improves mortar, by giving it tenacity, and rendering it less apt to crack in drying; the quantity should not exceed one-fourth of the lime employed. If a little manganese is added, it acquires the important property of hardening under water, and becomes a good hydraulic cement.

Roman Cement.—In fifteen gallons of water, dissolve three pounds and a half of green copperas. Then, if one bushel of lime is mixed with half a bushel of fine gravel sand, and the copperas water added to it, and kept continually stirring while using, the cement will be very strong and durable.

Mortar for Furnaces.—Take any quantity of red or brick clay, and mix it with water, in which horse-dung and chimney-soot have been steeped. To four parts of this

mixture add one part of lime. The bricks wrought with this mortar will bind together, and endure the fire without separating at the joints. About a sixth part of burnt bones will much improve it.

Plaster in Imitation of Marble.—This species of plastering is exquisitely beautiful when done with taste and judgment. It may be made to resemble marble both in appearance and to the touch, so nearly as to be with difficulty distinguished from the stone itself. So much depends upon the workman, that it will be impossible without actual practice and observation, to succeed. Procure some fine plaster of Paris, and when wanted for use, temper it with clear glue, or other material of like nature. In this mixture diffuse the color of the stone you wish to imitate, observing that when you wish to imitate marble of various colors, you must have separate vessels to put the colored compositions in. Those acquainted with coloring walls will understand the colors most proper for this purpose. Having then the wall or column prepared with rough plaster, cover it with this composition, and while floating it on, put in the colors of the marble you wish to represent. As soon as the composition is hard enough, polish it, by rubbing it with pumice stone kept wet with a sponge and water. It is next polished with tripoli and charcoal on a piece of linen, and finished with a mixture of oil and tripoli on a piece of felt.

Incombustible Wash for Wooden Buildings.—Slake your lime with hot water, in a small tub covered to keep in the steam, and afterwards strain it through a fine sieve. Into a gallon of water put six quarts of this lime, and one quart of clean rock-salt, previously dissolved by boiling. To every five gallons, add one pound of alum, half a pound of copperas, and twelve ounces of potash gradually added, and four quarts of fine sand. Any coloring matter may be mixed to give it the requisite shade. It will be better than paint, and as lasting as slate, when applied to shingles. The work should be clean, and the wash applied hot with a painter's brush.

BRILLIANT STUCCO-WHITE-WASH, for buildings, inside and out. Take clean lumps of well burnt lime, slake it as before. To five gallons add four ounces of whiting, one pound of sugar, and three pints of rice flour made into a very thin boiled paste, and one pound of clean glue, dissolved with heat. It may be applied cold within doors, but warm outside, and will retain its brilliancy many years. The east end of the President's House in Washington, is washed with it.

DEATHS FROM DRINKING COLD WATER.—From the injurious effects which have already arisen, and are likely to arise, from the free use of cold water during the summer months, we are induced strongly to recommend to masons and builders, to furnish their tenders and laborers with a drink composed of molasses, water and ginger. It is cheap, and palatable, and a larger quantity can be drank without injury than any other drink with which we are acquainted. We have tried it ourselves, and have drunk considerable ice water with impunity, by merely adding a little of the powder, or extract of ginger. JUNIUS.

Boston, July 10th, 1834.

[From the Journal of the Franklin Institute.]

VEHICLE FOR MINIATURE PAINTERS.

[From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.]

THE Silver Isis Medal was presented to Mr. J. Hammond Jones, miniature painter, for his fluid intended to be used as a vehicle for colors in miniature painting.

Ivory used to be, and still is, the material on which most miniature paintings are executed; but of late, slabs of fine porcelain biscuit ware have been introduced in its place, as being easier to obtain of large dimensions, and as affording a firmer hold for the colors than ivory does, on account of the great difficulty of freeing that substance entirely from oil.

The pigments used by the painter of miniatures are mixed up with gum water; but as gum is a substance very

soluble in water, there is a considerable difficulty in laying a tint cleanly and evenly over another, from the liability of the gum contained in the first tint to soften on the application of the second, and thus produce a muddy color intermediate between the two. If the artist, also, happens to be short-sighted, he is obliged to bring his face very near his work, and then the moisture of the breath will scarcely allow the tints that are mixed up with gum-water to dry.

The liquid vehicle that Mr. Jones employs for his colors is a cold saturated solution of borax in distilled water, in every quart of which is afterwards dissolved a quarter of an ounce of gum tragacanth.

The ivory or porcelain plate is first to be covered with two or three layers of the liquor, allowing sufficient time for one layer to dry before the next is added; and then the colors are laid on, each being mixed to a proper consistence with a few drops of the liquid.

The above-mentioned vehicle renders whatever color it may be united with so hard and firm, when dry, that tints may be laid or washed over each other with the same ease as tints of water colors on paper; and thus the artist is enabled to work in his draperies and back grounds with more boldness, facility, and expedition.

THE SHORT WAY TO POVERTY.

Wealth, like the oak, is not the growth of a year; it increaseth by little and little. The daily addition of pence, makes the full purse in time. But the full purse, remark, can be emptied in a moment. Habitual idleness, the repeated glass of bitters in the morning, mug of flip at noon, and hand of cards at night, are the sure conductors to poverty; but there is a shorter cut.

The plant and tree that grow the fastest, commonly decay the first; the swift runner is soonest tired; and the shortest way to find poverty, is to grasp too eagerly at wealth.

Witness Richard Runfast; he had five or six hundred pounds left him by a legacy, opened a shop of goods in the country, and was doing very well, while under his uncle Careful's eye; a hundred pounds clear gain at the year's

end:—but this would not do; he must move to Boston; that is the place to make worlds of wealth in a minute.

High rents, expensive living, a few bad debts, make his profit and loss about equal the first year; this he calls a good beginning. He must make a bolder push. Navigation is the next step. He strains his credit to the farthest limit, charters a vessel, puts on board four times as much as he is worth; the whole is afloat, and he is calculating upon a hundred per cent. profit.

He intends to fit out his own vessel next year; rides into the country to engage timber; fancies every oak he sees growing, will, some time or other, be sawn into plank for his merchantmen.

Stop, fancy. Listen, avarice, and hear the news. He is counting his chickens before they are hatched. The brotherly French have seized his ship and cargo for his part of the national debt of gratitude we owe them. Poor Richard has run too fast. I need not inform you he has shut up shop. Oh the British treaty! why did not Jay insert an article, that should make robbers on land honest at sea?

WIN GOLD AND WEAR IT.

Many suppose the plain meaning of this text is, *lay your earnings out in clothes;* others have thought it referred to gamblers. They would do well to understand it literally.

If you have been so unfortunate as to win money at the card table, I should choose to see it sparkling in a pair of paste knee-buckles, or dangling in a gold watch chain, or pearl key, rather than trusted again to the disposal of these fickle arbitrators, hearts, diamonds, clubs and spades.

Whatever may be your opinion of law decisions, I verily believe your money would stand a better chance with lawyer, judge and jury.

If gamblers win gold, let them wear it.

I am inclined to think the sage authors of good old English proverbs, intended something more here than has been observed. Their adages are brimfull of meaning; so full of good wholesome every day fare, that the sickly stomachs of your Lord Chesterfields, and your humble servant Smockface, cannot digest them.

But the Prompter, whose writings have a much more conspicuous place in the library of common sense, than my Lord Chesterfield's, is not so squeamish; according to him, 'they contain the experience, the wisdom of nations and ages, compressed into the compass of a nut shell.' This, I hope, will be a sufficient apology for my frequent use of those old sayings, homespun expressions, and coarse ideas, so offensive to those who are 'more refined than refinement, more sensible than sense;' or, as I understand it, justly foolish as folly.

Now I believe if we crack the shell of this nut I have sent you, wrapt up in a periodical, you will find no jest, that will burst your sides with laughter, but this wholesome viand, '*Earn industriously and spend prudently*,' which will not only afford you nourishment from the first of January to the last of December, but prevent the necessity of taking a single pill from the doctor, and keep you warm in the coldest winter day. As this is a large mouthful, and so full of nutriment, I advise you, if you have a good store of last year's corn, meat and cider, to lay it by until next month; in the mean time, if I have an hour's leisure, I will set down and pick it to pieces, with my pen, as my manner is, and have it better prepared for your use.

MISCELLANY.

A NEW GIGANTIC TELESCOPE.—A great work has just been completed, in all its essential parts, in Utzchneider's manufactory of optical instruments at Munich. It is a gigantic telescope, on Frauenhofer's principle, of fifteen Paris feet focal distance, and an aperture of 10 inches and a half. It surpasses in size and power the largest telescopes made in the life-time of the illustrious Frauenhofer. It has been tried with the greatest strictness by the professors of astronomy in the university of Munich, and declared to be a perfect master-piece. The clearness and distinctness of a heavenly body seen through it, is to that of the Dorpat telescope made by Frauenhofer, of 13 feet focal distance, and 9 inches aperture, as 21 to 18, and the intensity of the light as 136 to 100. It magnifies far above 1000 times, and the ordinary

expression of bringing an object nearer may be literally applied; thus when Saturn at its smallest distance from the earth, is 166,000,000 geographical miles distant, it seems, when magnified 816 times by this telescope, to have approached to the distance of 200,000 geographical miles; and the moon, at her smallest distance from the earth seems, when magnified in the same manner, to have approached within 68 geographical miles, which is but little more than the distance in a direct line from Athens to Constantinople.

India Rubber.—One of the most important discoveries of this age of wonderful inventions is that of a composition,—the principal ingredient in which is India rubber,—which can be applied to cloth, leather and other articles, without materially changing the character of the rubber or the cloth.

The former retains all its elasticity and imperviousness to water, while it adds threefold strength to its subtratum; the latter preserves its gloss and peculiar texture unimpared. Among the innumerable cases to which this preparation may be advantageously appropriated, we are surprised never to have heard of its being employed in the *covering of umbrellas.* This would seem to be the first and most legitimate purpose to which it could be applied, now that the manufacturers have brought it to the perfection of spreading it almost to the thinness of blotting paper, without deducting from its peculiar and characteristic qualities. Unless there is some insuperable objection to this application of the discovery, we would recommend to those interested in this manner, a trial of it on umbrellas.

Besides this, it occurs to me, that it would be a capital substitute for the baize with which inner doors are covered. Why not use it too for blacksmith's bellows?

Poisonous Beads.—Those beautiful red peas with a black spot, brought from India, which are sometimes worn as ornaments of dress, are said by the natives to be so dangerous, that the half of one of them is sufficiently poisonous to destroy a man. This account, however, seems to exceed probability; but they have a very prejudicial quality, I have no doubt, for, within my own knowledge, I have seen an extraordinary effect of the poison of one of these peas. A poor woman, who had some of them given to her, and who did not choose to be at the expense of having them drilled to make a necklace, put the seeds into hot water till they were sufficiently soft to be perforated with a large needle; in performing this operation, she accidentally wounded her finger, which soon swelled and became very painful

the swelling extended to the whole hand; and it was a considerable time before she recovered the use of it. The botanical name of the plant that produces this pea is Abrusal precaldrius.

Locusts.—One of these living clouds, which was three whole days and nights, without apparent intermission, passing over Smyrna, must have been, according to accurate observations made at the time, three hundred yards in depth, upwards of forty miles in width, and nearly five hundred miles in length. Capt. Basil Hall calculates that the lowest number of locusts in this enormous swarm, must have exceeded 168,603,563,200,000; and, in order to assist the imagination, Capt. Beaufort determined that this cloud of locusts, which he saw drifting by when he lay at Smyrna, if formed into a heap, would have exceeded in magnitude more than a thousand and thirty times the largest pyramid of Egypt; or, if they had been placed on the ground close together, they would have encircled the globe with a band a mile and a furlong wide!

Velocity of Balloons.—The velocity of eighty miles per hour is that by which the æronaut Garnerin was carried in his balloon from Ranelagh to Colchester, in June, 1802. It was a strong and boisterous wind, but did not assume the character of a hurricane, although a wind with that velocity is so characterized by Rance's Table. In Mr. Green's ærial voyage from Leeds, in September, 1823, he travelled 43 miles in 18 minutes, although his balloons rose to the height of more than 4,000 yards.

Hot-Bed Fences.—In England it is common to have fences of the stalks of bull-rushes and other similar plants to protect their hot-beds from cold, chilling winds. A gardener residing on Long Island, makes them of the stalks of broom corn. Posts about six feet apart are put in the ground, and three lasts or strips of board are laid on, between which the stalks are perpendicularly placed. A fence from five to seven feet high is thus made around the hot-beds.

In Germany they dry and reduce to powder the roots of the dandelion, which they mix, in proportion of one third, with their coffee, on account of its cooling properties, preferring much this mixture to pure coffee, or tea, as more nourishing and healthful. In short, dandelions have always been considered in France and Germany as peculiarly useful in all visceral obstructions when eaten as greens and salad, or otherwise.

QUESTIONS.

1. Will some correspondent give us an explanation of the principles of the arithmetical rule of double position?

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2. Required to inscribe within a circle of 10 inches diameter, a triangle of half the area of the circle. How many different triangles of this dimension can be thus inscribed, and of what angles?

ANSWERS.

The following, are answers to the first and second questions, in the March number of the Mechanic.

1. By inscribing the triangle, it will be seen that a perpendicular let fall from one angle upon a side is 1 1-2 times the radius of the circle. The diameter here being 12, the radius is 6, and the perpendicular is 9. The square of the perpendicular is also equal to the square of one side minus the square of one-half the side; equal to three-fourths the square of one side. Let then x = the side. $3\text{-}4\ x^2 = 81$ = the square of 9, the perpendicular. Then $x^2 = 108$, and $x = 10{\cdot}39$.

2. The lines will meet as the writer supposes, and that point of meeting is the centre of gravity of the triangle, but not at the precise distance he mentions. Demonstration.—1. A line drawn from the vertex of a triangle to bisect the opposite side, divides the triangle into equal portions, so that the triangle will balance on this line. The centre of gravity, must therefore be in this line, and the same of all the lines, which must, therefore, meet at the centre of gravity.

2. The line drawn parallel to the base through this centre must also for similar reasons divide the circle into two equal parts. Hence, by the laws of proportional triangles and their parts, the *square* of the whole dividing line is double the square of the line from the vertex to the centre of gravity. Or in other words, the squares of similar sides of lines, of similar triangles, are in proportion to the triangles themelves.

Suppose, for instance, the line was 10 inches. Its square is 100, and half its square fifty, the square root of which is a little fraction over seven, for the distance from the vertex to the meeting point, and the distance thence to the base is, of course, a little short of 3 inches.